

Bellwork: 5/17/13

Evaluate each logarithm:

1)  $\log_3 27 = x$

$$3^x = 27$$

$$\boxed{x = 3}$$

2)  $\log_2 (1/32) = x$

$$2^x = \frac{1}{32}$$

$$\boxed{x = -5}$$

3)  $\log_9 3 = x$

$$9^x = 3$$

$$\boxed{x = \frac{1}{2}}$$

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21)  $\log_4 64 = x$       22)  $\log_6 216 = x$   
 $x = 3$        $x = 3$

23)  $\log_4 16 = x$       24)  $\log_3 \frac{1}{243} = x$   
 $x = 2$        $x = -5$

25)  $\log_5 125 = x$       26)  $\log_2 4 = x$   
 $x = 3$        $x = 2$

27)  $\log_{343} 7 = x$       28)  $\log_2 16 = x$   
 $x = \frac{1}{3}$        $x = 4$

29)  $\log_{64} 4 = x$       30)  $\log_6 \frac{1}{216} = x$   
 $x = \frac{1}{3}$        $x = -3$

$$343^{\frac{1}{3}} = \sqrt[3]{343}$$

49  
77

$$64^{\frac{1}{4}} = \sqrt[4]{64}$$

16  
44

## 7.4 Properties of Logarithmic Functions

Obj: Students will be able to use the properties of logarithms to simplify expressions.

$$* = +$$

$$\div = -$$

$$\text{exp} = \text{front}$$

### Exponents

Product Property

$$(a)^m(a)^n = a^{m+n}$$

$$x^4 \cdot x^3 = x^7$$

Quotient Property

$$\frac{a^m}{a^n} = a^{m-n}$$

$$\frac{x^4}{x^3} = x^1$$

Power Property

$$(a^m)^n = a^{m \cdot n}$$

$$(x^4)^3 = x^{12}$$

### Logarithms

$$\log_b(m \cdot n) = \underline{\hspace{2cm}}$$

$$\log_b\left(\frac{m}{n}\right) = \underline{\hspace{2cm}}$$

$$\log_b m^p = \underline{\hspace{2cm}}$$

$$x + x + x + x$$

$$\begin{aligned} \log_b(a^4) &= \log_b(a \cdot a \cdot a \cdot a) \\ &= \log_b a + \log_b a + \log_b a + \log_b a \\ &= 4\log_b a \end{aligned}$$

Example 1: Write each logarithm as a single logarithm.  $\rightarrow$  write log once

1.)  $\log_3 9 + \log_3 3 =$

$$\log_3 9 \cdot 3 = \boxed{\log_3 27}$$

2.)  $\log_2 5 + \log_2 8 =$

$$\log_2 5 \cdot 8 = \boxed{\log_2 40}$$

3.)  $\log_5 625 - \log_5 125 =$

$$\log_5 \frac{625}{125} = \boxed{\log_5 5}$$

4.)  $\log_7 20 - \log_7 2 =$

$$\log_7 \frac{20}{2} = \boxed{\log_7 10}$$

5.)  $\log_8 16 + \log_8 10 =$

$$\log_8 16 \cdot 10 = \boxed{\log_8 160}$$

6.)  $\log_3 15 - \log_3 5 =$

$$\log_3 \frac{15}{5} = \boxed{\log_3 3}$$

7.)  $2\log_3 2 + 3\log_3 4 =$

$$\log_3 2^2 + \log_3 4^3$$

$$\log_3 4 + \log_3 64 = \boxed{\log_3 256}$$

8.)  $5\log_6 x - 3\log_6 y =$

$$\log_6 x^5 - \log_6 y^3$$

$$\boxed{\log_6 \frac{x^5}{y^3}}$$

## Properties of Logarithms

Properties of Logarithms		
Product Property	Quotient Property	Power Property
$\log_b mn =$ _____	$\log_b \frac{m}{n} =$ _____	$\log_b m^n =$ _____

Write each expression as a single logarithm. *one log*

1.  $\log_3 9 + \log_3 24$

$$\log_3 9 \cdot 24$$

$$\log_3 216$$

2.  $\log_4 16^3$

$$\log_4 4096$$

3.  $\log_2 7 - \log_2 9$

$$\log_2 \frac{7}{9}$$

4.  $\log_3 8^5$

$$\log_3 32,768$$

5.  $\log_4 x - \log_4 y$

$$\log_4 \frac{x}{y}$$

6.  $\log 5 + \log 7$

$$\log 35$$

*no base = 10*

Expand each logarithm. Simplify if possible.

7.  $\log_3 27x$

8.  $\log \frac{3}{7}$

9.  $\log_4 y^2 z^3$

10.  $\log_5 \frac{3^2}{x}$

11.  $\log_3 15xy$

12.  $\log 8xz^4$

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## Practice

Form G

## Properties of Logarithms

one log

Write each expression as a single logarithm.

1.  $\log_5 4 + \log_5 3$

2.  $\log_6 25 - \log_6 5$

3.  $\log_2 4 + \log_2 2 - \log_2 8$

$$\log_2 \frac{4 \cdot 2}{8} = \log_2 \frac{8}{8}$$

$$\boxed{\log_2 1}$$

4.  $5 \log_7 x = 2 \log_7 x$

5.  $\log_4 60 - \log_4 4 + \log_4 x$

$$\log_4 \frac{60}{4} \cdot x$$

$$\boxed{\log_4 15x}$$

6.  $\log 7 - \log 3 + \log 6$

$$\log \frac{7 \cdot 6}{3}$$

7.  $2 \log x - 3 \log y$

8.  $\frac{1}{2} \log r + \frac{1}{3} \log s - \frac{1}{4} \log t$

$$\log r^{\frac{1}{2}} + \log s^{\frac{1}{3}} - \log t^{\frac{1}{4}}$$

9.  $\log_3 4x + 2 \log_3 5y$

$$\log_3 4x + \log_3 25y^2$$

$$\log_3 100xy^2$$

Homework: 5/17p.21 - ALL

